

**Roads and Grizzlies**  
**What Do We Know So Far?**

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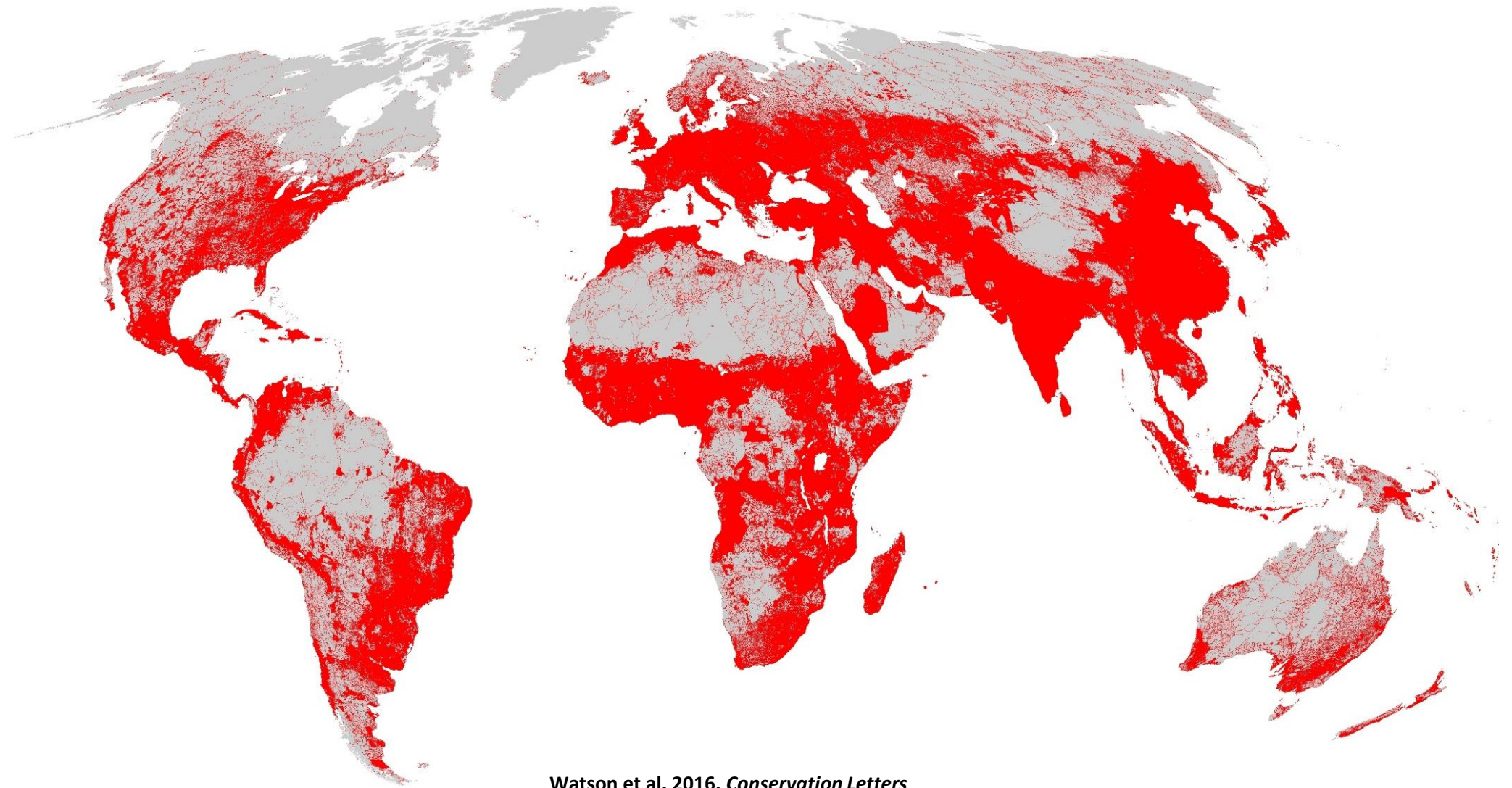
**Dr Tony Clevenger**  
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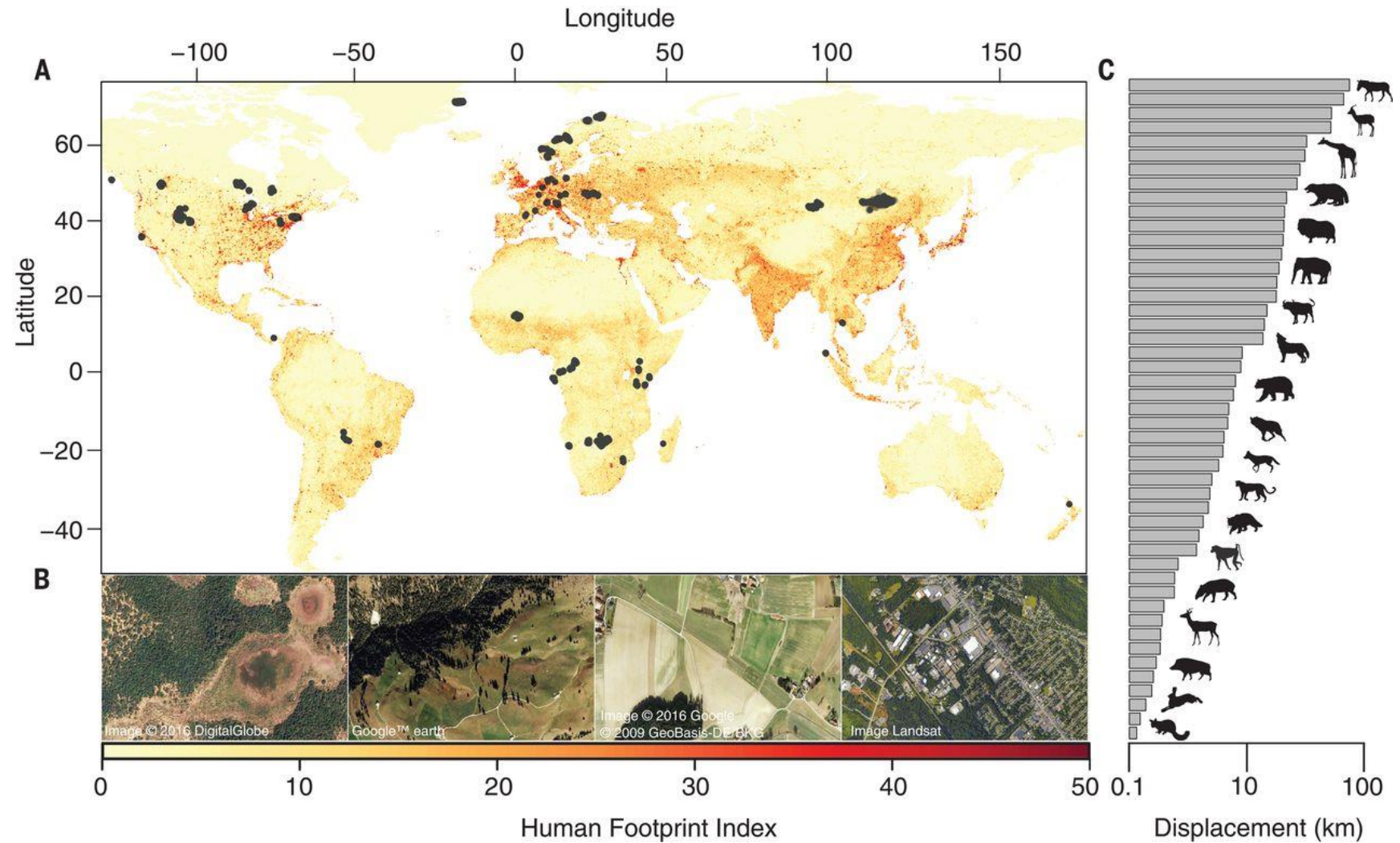
More than 50% of the planet  
now human-dominated landscapes



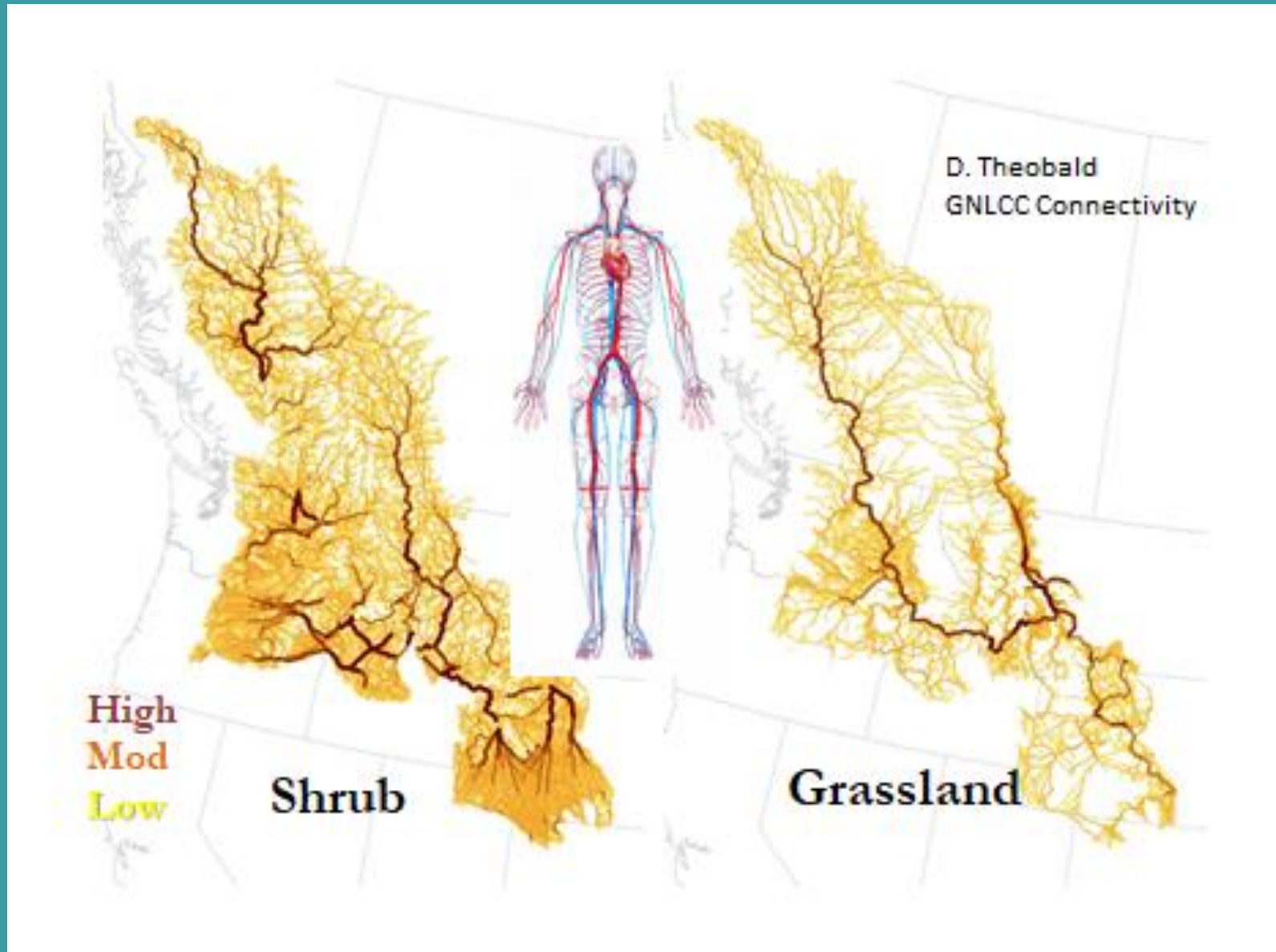
Watson et al. 2016. *Conservation Letters*



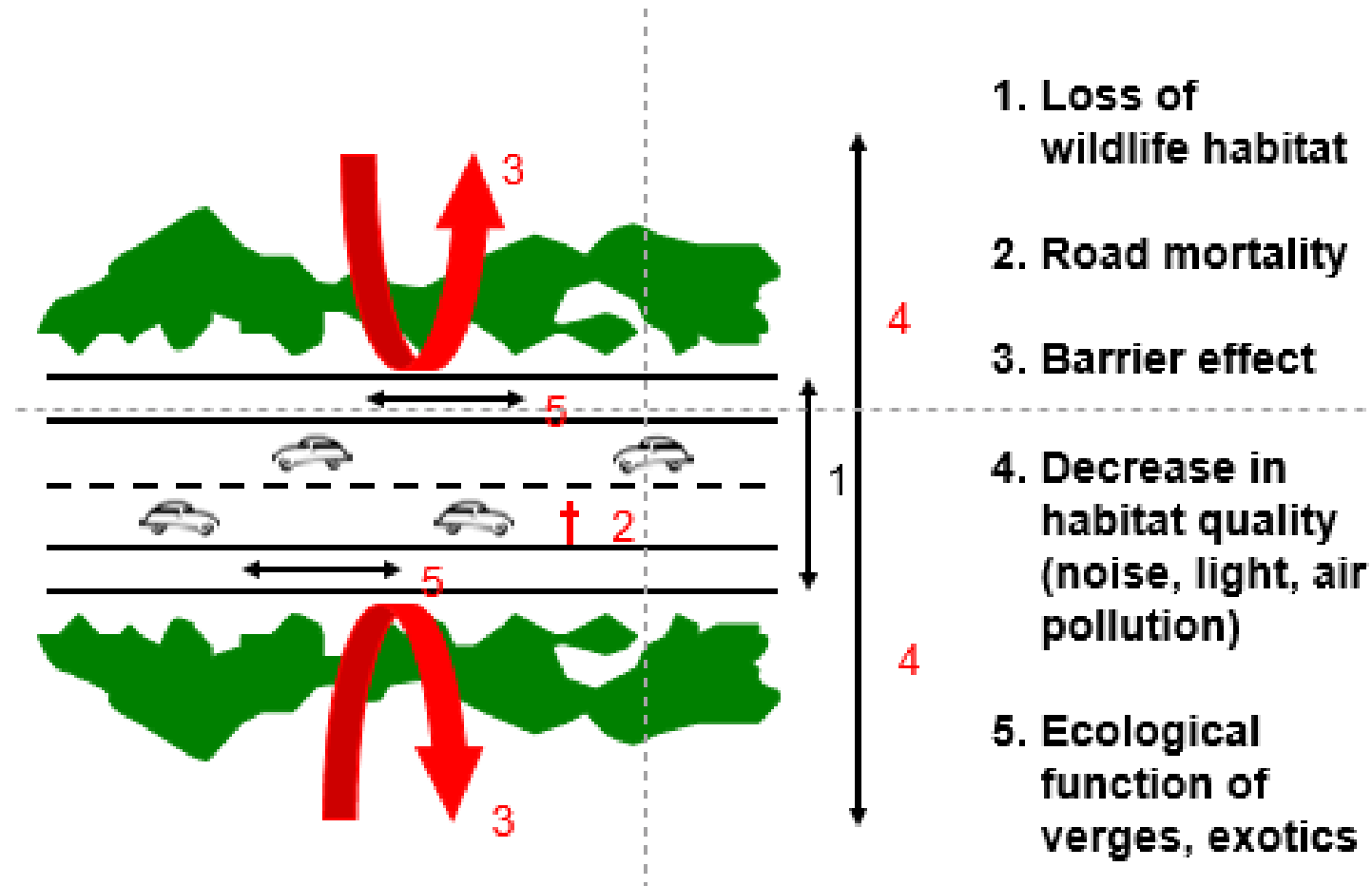
# Moving in the Anthropocene: Global reductions in terrestrial mammalian movements



# Connectivity = Circulatory System of Nature



# Some Ecological Impacts of Roads and Rails







Adam Ford



National Park Poster: 1930's

## Traffic Volume: Barrier Thresholds

- In Montana, USA, Waller et al. (2005, 2015) used radio collars and traffic data, and found that:

***traffic >100 VPH was a complete barrier for grizzly bears***

- Thresholds like these can be used to plan when and where to implement mitigation, especially as traffic volumes increase over time.





## TRAFFIC MATTERS

### Grizzlies and US Highway 2 along Glacier NP

100 vehicles per hour (vph) are total grizzly bear barrier

- In 2001, 100 vph exceeded for 10 hours per day
- In 2013, 100 vph exceeded for 12 hours per day ( 9am-10pm)
- By 2018, 100 vph projected to exceed 15 hours per day



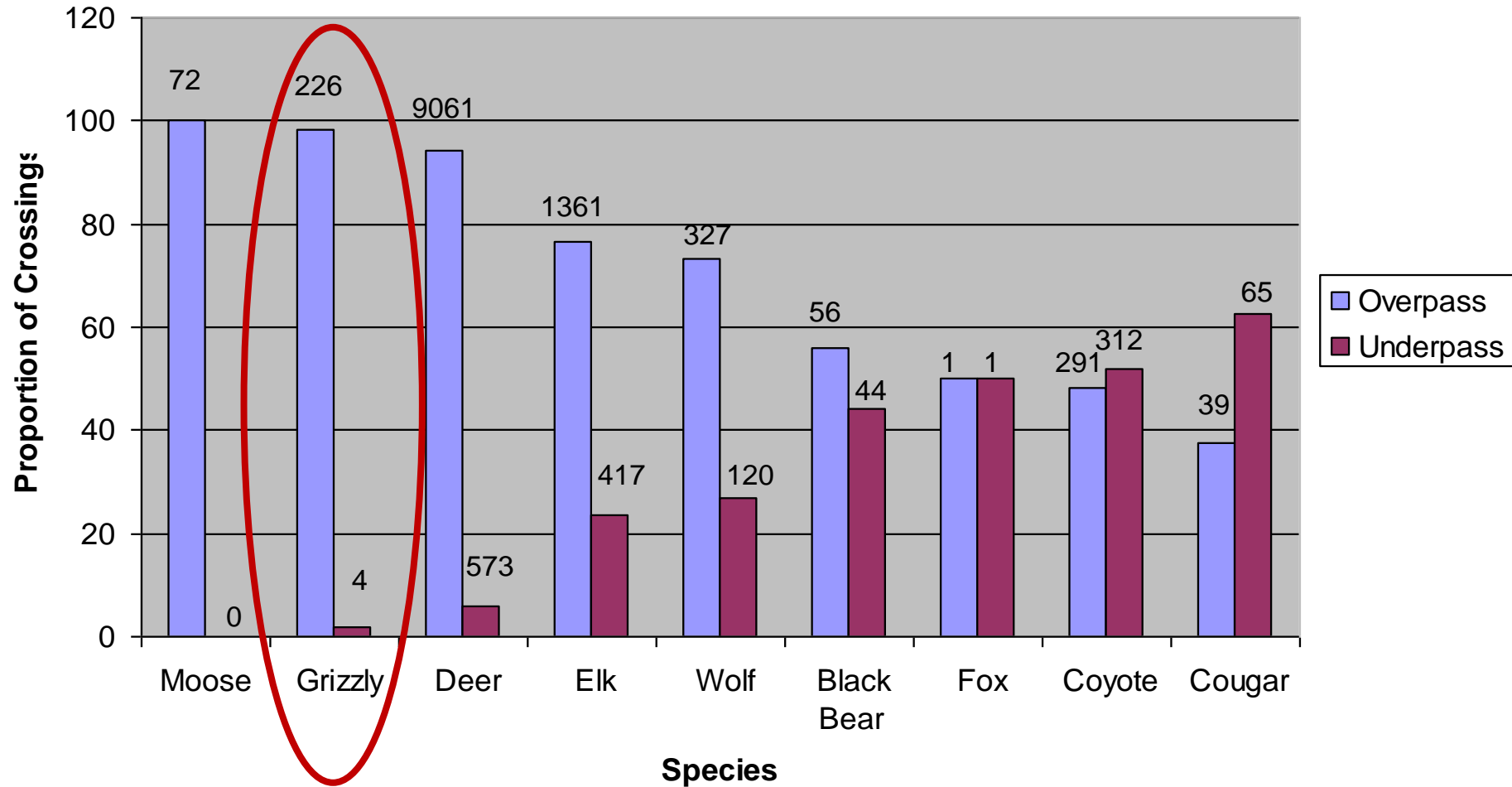
## Case Study: Banff National Park, Alberta



- 44 WCs
- 5 design types
- 3 time periods (1985, 1997, 2011)
- Long-term monitoring (17+ years)
- Collateral parks wildlife research

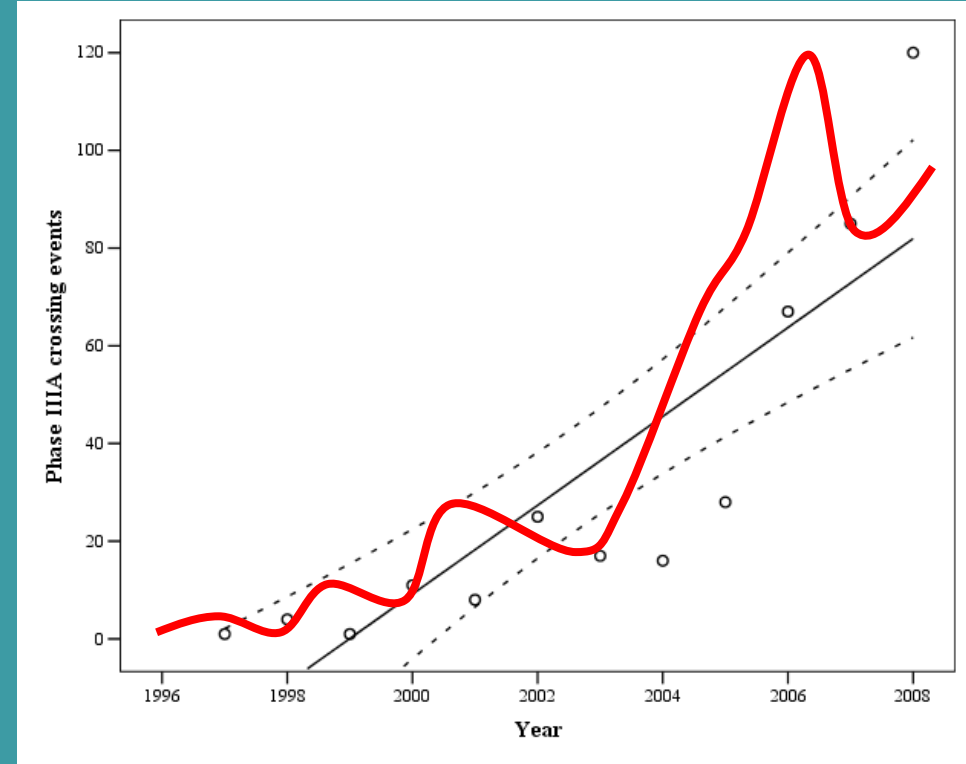
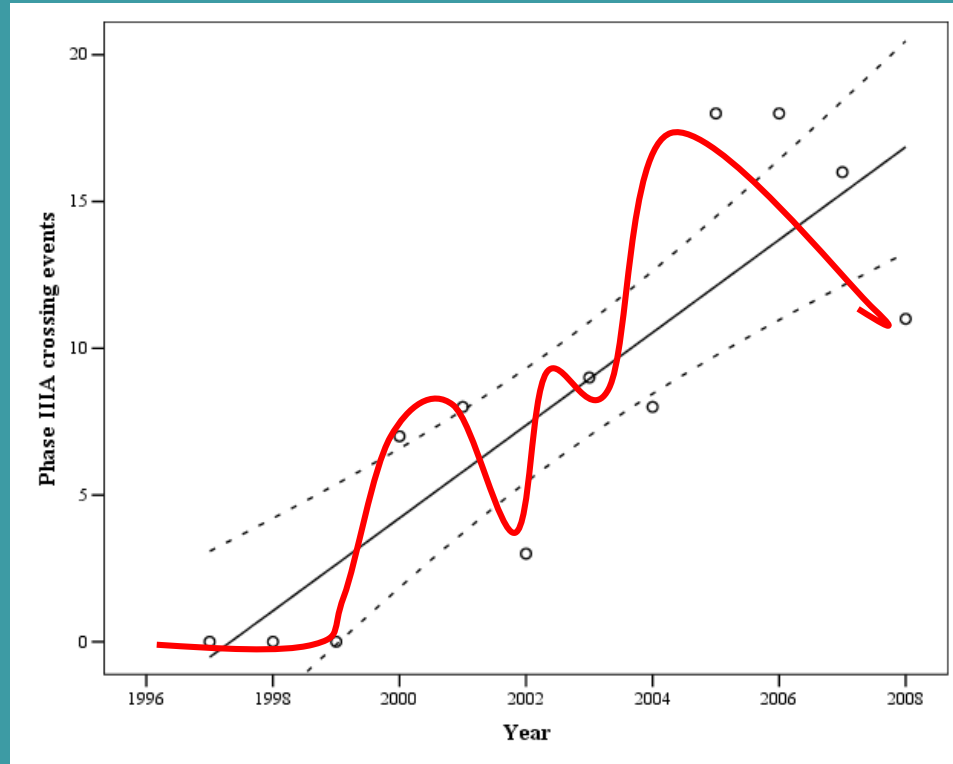
# Over and Under – Do species have preferences?

## Wildlife Use of Banff Overpasses and Underpasses





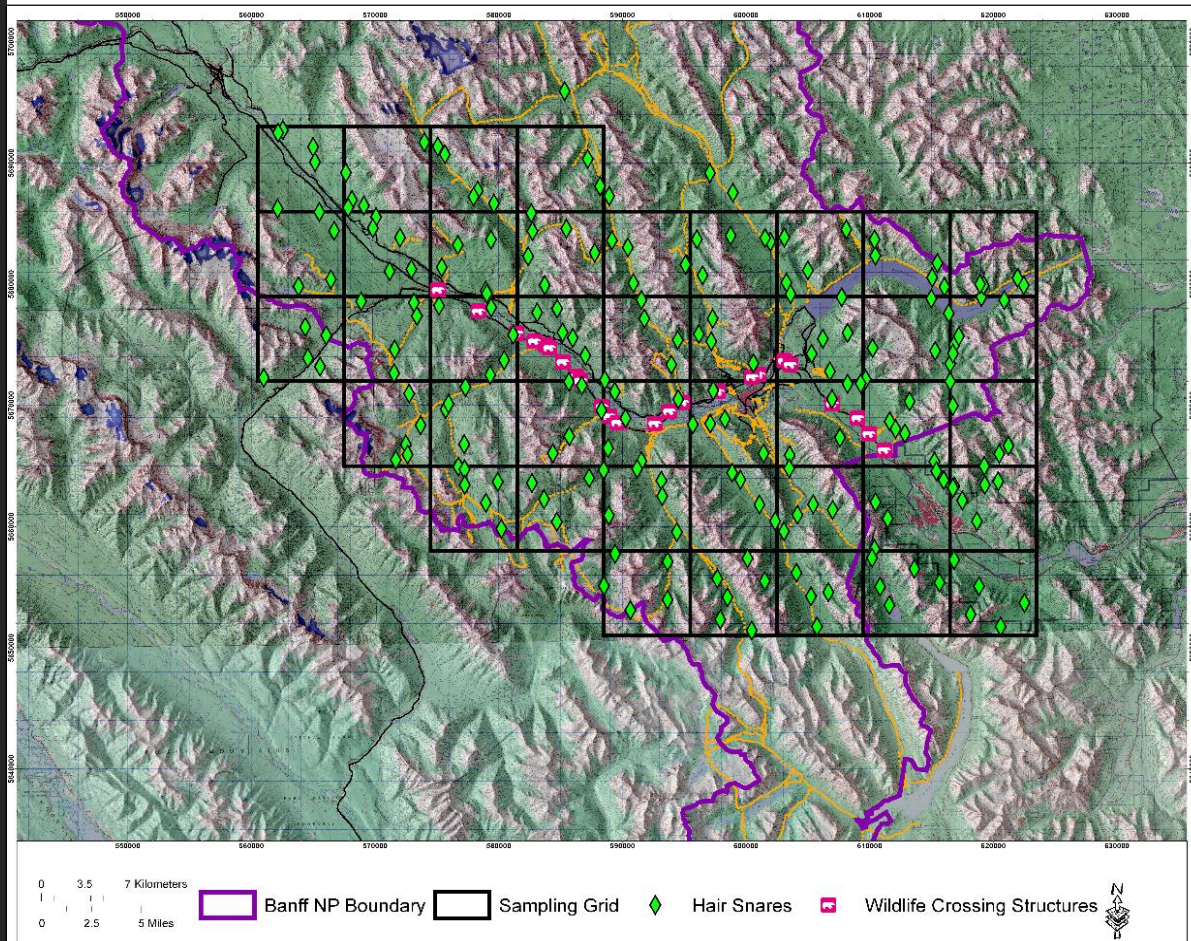
# Adaptation/Learning Curve





# What about population demographics and genetics?

Do crossings do more than simply allow wildlife to pass safely?





# Conclusions: Genetic Connectivity



- TCH was associated with a genetic discontinuity for grizzly bears, but not black bears.
- Migration rates high enough to prevent genetic isolation.
- Many bears using crossings were successful breeders.
- Many grizzly bears using crossings structures were offspring of parents using crossings.
- Bears from both sides of TCH used crossing structures.





## Size Matters

- All grizzlies selected larger structures – overpasses & open spans
- Use has increased with time – 17 years of data
- Family groups strongly selected overpasses

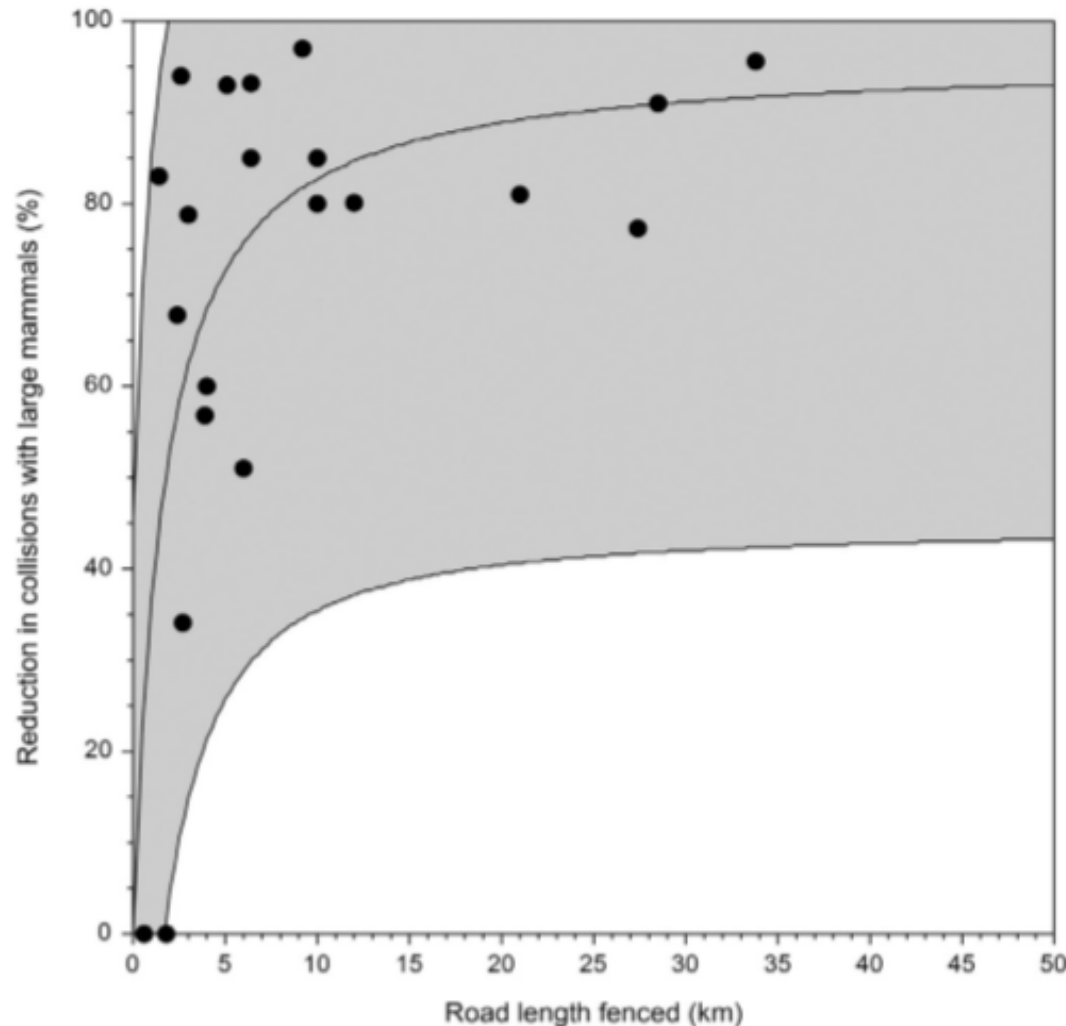
### Most important finding:

“If PCA would have built only cheaper underpasses, demographic connectivity would have been severed”



Tony Clevenger, PCA

## Crossing Structures and Fencing: Findings from a meta-analysis



Short fences ( $\leq 5$  km road length) had lower (52.7%) and more variable (0–94%) effectiveness in reducing collisions than long fences ( $>5$  km) (typically  $>80\%$  reduction);

